SYSTEM FOR ENCODING DATA IN MACHINE READABLE GRAPHIC FORM

This is a division, of application Ser. No. 550,023 filed Jul. 9, 1990, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention generally relates to the representation of data in machine readable form and more particularly to a system for the encryption of data into a two-dimensional graphic image that can be automatically machine read to obtain the encoded data in both open and closed systems.

2. Description of the Prior Art

In todays high technology world more and more operations are being automatically performed by machines and systems. This ever-increasing drive for automation has resulted in a demand for new techniques for encoding data into machine readable form for automatic entry into the various systems and machinery. The data entry may be for such uses as data transmission, operating various machine functions or the identification of persons or items. The various media that carry the data for automatic entry include punch cards, magnetic tapes and discs and magnetic stripes on cards such as credit cards and badges. The systems utilizing the above carriers are in "closed" systems, i.e. the read function is performed within an apparatus or housing and the reading element is in contact or in near-contact with the carrier means during the reading operation.

One method for representing data in a machine readable form is to encode the data into a pattern of indicia having parts of different light reflectivity, for example, bar code symbols. A bar code symbol is a pattern comprised of a series of bars of various widths and spaced apart from one another by spaces of various widths, the bars and spaces having different light reflective properties. The bar code symbol is optically scanned and the resulting electrical signals are decoded into data representative of the symbol for further processing. Bar code reading systems are known as "open" systems in that the carrier while being read is not sealed, but is read from a distance and without being in physical contact with the scanner.

The conventional bar code described above is "one-dimensional" in that the information encoded therein is represented by the width of the bars and spaces, which extend in a single dimension. Similarly data encoded onto other media such as credit card magnetic stripes is composed of one or more "one-dimensional" tracks of encoded data.

The use of bar code symbols and magnetically encoded data has found wide acceptance in almost every type of industry. However, the one dimensional nature of the encoded data limits the amount of information that can be encoded and hence use has been generally restricted to simple digital representations.

Thus, there is a need for a system to encode data in machine readable form that allows for an increase in the amount of data encoded into a given space that can be quickly and easily decoded for further processing.

SUMMARY OF THE INVENTION

The present invention is directed to a system for representing and recognizing data in machine readable graphic image form having an increased capacity for encoded information that can be used in both open and closed systems. The system comprises an encoding means having a means for entering data such as a keyboard or optical character scanner. In addition, the data may be obtained directly from computer files. The data entered into the system may be both textual data and control data. The data is entered into a processing means for encoding the data into a two-dimensional pattern of graphic indicia. The graphic indicia may, for example, be in the form of a two-dimensional bar code which is comprised of a pattern of vertical bars of predetermined lengths that are spaced at various vertical and horizontal intervals. It should be understood that the graphic indicia representative of the data is not limited to a bar code symbol type, but may be in the form of any two-dimensional graphic pattern of indicia suitable for encoding data.

The processing means generates electrical drive signals for transferring the two-dimensional graphic pattern onto a data carrier means, that may be a card or document or the surface of a machine part. The encoding means also includes means for transferring an image of the two-dimensional pattern of graphic indicia onto the data carrier means in response to the transfer drive signals.

The image may for example be printed in the form of a two-dimensional pattern of graphic indicia having different areas of light reflectivity in which the indicia have one level of reflectivity and the spaces have another level of reflectivity. In this embodiment, the converting means may be a type of optical scanner typically used for scanning one-dimensional bar codes that converts the areas of different light reflectivity into electrical signals representative of the indicia. Scanners employed in the present invention, however, have the added feature of scanning the indicia in two dimensions. For example, in one method a laser light beam is scanned across the indicia in a raster pattern for reading and decoding two-dimensional graphic codes. Optical scanners suitable for reading two-dimensional patterns are disclosed in U.S. patent application Ser. Nos. 317,433 and 317,533, filed Mar. 1, 1989, assigned to the same assignee as the present invention and incorporated herein by reference.

The system of the present invention further includes a recognition means comprising means for converting the image on the carrier means into electrical signals representative of the graphic indicia and means for decoding the electrical signals into output signals representative of the data.

The decoded output signals are available for further processing and the system may therefore include means for outputting the decoder output signals. Typical output devices may include a liquid crystal display, a CRT display and a printer. The outputted signals may also be transmitted to a computer or other system for further processing and use via telephone lines using a modem or via a data bus.

The present invention contemplates the outputting of the decoder output signals to a microprocessor for controlling the operation of various machines such as facsimile, VCR, microwave oven, robotic systems and weight/price label scale devices.

In another embodiment of the invention, the processing means encodes a first set of data into the two-dimensional pattern of graphic indicia and generates first transfer drive signals for transferring the two-dimensional pattern onto a carrier means. The processing